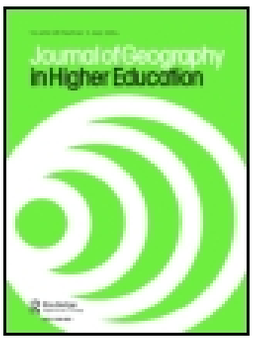

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'Nature-enhanced learning' and geography education

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ABSTRACT

Accumulating evidence suggests that a range of benefits might accrue from conducting teaching and learning outside in natural environments, and more broadly, from incorporating some kind of contact with nature into teaching and learning activities. Although this evidence does not stem from studies that have focused on geographical higher education, geography educators may be interested in the possible implications for their teaching practice. Framed by this concern, this review considers the evidence for nature's beneficial effects, primarily in relation to learning, but also in terms of academic performance, cognitive function, health, wellbeing and personal development. It is concluded that it might be desirable for geography educators to explore opportunities to increase geography students' contact with nature. Practical recommendations for how this could be achieved are suggested.

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Introduction

Accumulating evidence suggests that a range of benefits might accrue from conducting teaching and learning outside in natural environments, and more broadly, from incorporating some kind of contact with nature into teaching and learning activities. In educational settings, studies suggest that nature can have positive effects on academic performance, cognitive function, skills development, physical activity, mental health, subjective wellbeing, social relations, personal characteristics, such as compassion and self-esteem, and environmental attitudes and behaviours (Becker et al., 2017; Dillon et al., 2006; Fiennes et al., 2015; Hattie et al., 1997; Lovell, 2016; Rickinson et al., 2004; Waite et al., 2016). This review considers this evidence. The implications for geographical higher education, in terms of whether geography educators should be encouraged to increase students' contact with nature, are considered. The review is organized into four sections. The next section considers the evidence for nature's beneficial effects on learning and various other items, and outlines the pathways via which some suggest it produces these effects. Findings on the potential benefits accrued from incorporating nature into teaching and learning activities in educational settings are then explored, before attention turns to the limitations of the evidence base. The conclusions and recommendations section reflects on the implications for geography education and proposes a small number of practical recommendations for geography educators.

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Although touched upon, the intent of this review is not to reflect on the pedagogical role and value of geography fieldwork and fieldtrips conducted in natural (and/or built) environments. A wealth of reviews and studies have explored this subject at length (see Gold et al., 1991; Herrick, 2010; Kent et al., 1997; Nairn, 2005; Orion & Hofstein, 1994). Rather, the intent is to convey findings from the environmental psychology literature on nature-learning relations, which may be less familiar to geographers, to build understanding of this important issue.

'Nature-enhanced learning'

The possible benefits derived from conducting teaching and learning in a wide variety of natural outdoor settings, from school gardens (Wistoft, 2013) to forests (Mygind, 2007), prairies (Ernst & Stanek, 2006) to farmland (Santelmann et al., 2011), have been advocated by certain groups (e.g. Forest Schools Association, International Association of Nature Pedagogy) and explored in research. Often, studies report positive effects (Dillon et al., 2006; Hattie et al., 1997; Lovell, 2016; Rickinson et al., 2004). For example, a recent systematic review of investigations into the effects of regular, compulsory school- and curriculum-based outdoor education programmes found that 11 of the 13 analysed studies reported positive effects, while one reported mixed positive and negative effects and one only negative effects (Becker et al., 2017). Further, a review of five recent meta-analyses of investigations into the effects of outdoor adventure learning concluded that, based on the evidence presented, students who participate in such learning make, on average, approximately four additional months' progress on academic outcomes compared to their non-participating peers (Education Endowment Foundation, 2018). Besides improved academic outcomes, studies have linked multiple social and non-cognitive benefits to outdoor learning, including: improved in-class behaviour, increased levels of physical activity (Mygind, 2007), enhanced inter-personal skills such as communication (Santelmann et al., 2011), better problem-solving and technology skills (Ernst & Stanek, 2006), and enhanced pro-environmental attitudes and behaviours (Moeed & Averill, 2010).

Linked to outdoor learning, various studies report that undergraduate geography students gain academic and social benefits from fieldwork and fieldtrips completed in natural environments. For example, Houser et al. (2011) found that the grades of students who participated in fieldwork completed in a Costa Rican cloud forest were significantly higher than those who did not participate. Boyle et al. (2007) found that fieldwork completed in the Cairngorms National Park in Scotland was valued by students, stimulated effective approaches to learning and increased students' confidence in both working with their peers and developing transferable skills. Whether it is the natural setting, the fieldwork itself or a combination of the two that delivers such benefits is, however, uncertain. There seems to be some general consensus around the idea that fieldtrips and fieldwork do, of themselves, confer benefits, but the "quality' of the trip/activity, determined by learning materials, teaching praxis and so forth (Orion & Hofstein, 1994), and the location or 'field' visited (Lonergan & Andresen, 1988), matter. It is claimed that fieldtrips and fieldwork, amongst other benefits, support productive student and student-lecturer relationships (Herrick, 2010), build knowledge and learning skills (Cook et al. 2006), support 'higher-order

learning' (comprehension, application, analysis, and synthesis of knowledge) (Kern & Carpenter, 1986) and 'experiential learning' (Kent et al., 1997) as, to borrow an argument from Bunge (1979), these activities enable students to gain 'sight' of the items and issues they 'cite'. In reflecting on the various benefits that the literature attributes to geography fieldwork and fieldtrips, it is interesting to note that studies often discuss activities completed in natural rather than urban settings; which is not to say that accounts of the benefits provided by urban fieldtrips and fieldwork are unavailable. Herrick (2010), for example, describes the benefits students gained from an undergraduate urban geography fieldtrip to San Francisco, USA, while Pawson and Teather (2002) discuss the value of undergraduate cultural geography fieldwork completed in Christchurch, New Zealand. Whether fieldwork and fieldtrips completed in 'natural' environments provide greater or different benefits to those completed in 'urban' environments is an area of uncertainty due to a paucity of studies on the issue. In contrast, studies have compared the effects of classroom versus 'field' based learning. Kern and Carpenter (1986), for example, compared the 'level' of learning associated with a classroom-based course on earth science and a field-oriented course. They identified almost identical levels of 'lower-order learning' (the simple remembering of information) amongst students on the two courses but those on the field-oriented course presented significantly higher levels of 'higher-order learning' indicating "an enhanced ability to understand and use acquired information" (ibid: 180). The 'field' in their study was a natural environment.

Looking beyond learning conducted in outdoor settings, a growing body of evidence identifies a positive relationship between learning and related outcomes, such as academic performance and cognitive function (Lovell, 2016), and various forms of contact with nature – from active to passive, immersive to remote, 'real' to 'virtual'. Studies have suggested that green views (Matsuoka, 2010), indoor plants (Barrett et al., 2017), computer simulations of nature (Lee et al., 2015), images of natural environments (Berman et al., 2008; Felsten, 2009), 'green' school grounds (Wu et al., 2014), wooden classroom furniture (Barrett et al., 2017), 'greener' home environments (Spero et al., 2019) and visits to natural environments (Berman et al., 2008; Spero et al., 2019) have positive effects. On these latter items, there is some evidence to suggest that students of geography and aligned subjects might be particularly advantaged by frequent interactions with nature and childhoods spent in 'greener' home environments. Spero et al. (2019, p. 434) recently found that college students who grew up in more rural environments and had more frequent contact with nature pre-college achieved, on average, higher grades than their classmates in an introductory environmental science course. Linking to this, although findings are mixed, some studies provide evidence of the importance of children's direct experience of landscape and environmental features, acquired through visits to natural environments or growing up in more natural spaces, and their knowledge of these items (see Alım, 2009; Harewood and Jackson, 1993). Although findings are again mixed, some studies have found associations between better performance on college-level agricultural and natural resource courses and growing up in rural environments on farms/ranches and previous agricultural experience (see Greene & Byler, 2004; Mousel et al., 2006). Taken together, findings on the benefits of outdoor learning in natural environments, and of exposure to nature more broadly, suggest that nature might support or facilitate learning, and might in particular support geography and environmental education. Just

as we talk about technology-enhanced learning, we might well talk about 'nature-enhanced learning'.

Exactly how nature might positively influence learning is a matter of debate with more research needed to draw firm conclusions (Hodson & Sander, 2017). One theory is that nature might facilitate learning by supporting recovery from 'mental fatigue' (Han, 2009). As set out in Kaplan and Kaplan's (Kaplan, 1995; Kaplan & Kaplan, 1989) Attention Restoration Theory (ART), it is argued, and there is some empirical evidence to suggest (Ohly et al., 2016), that nature helps individuals to recover from the mental fatigue that can result from any period of sustained mental effort. This theory suggests that we attend to the world via two attentional mechanisms – directed attention and involuntary attention (sometimes termed 'fascination'). The first is under voluntary control, it relies upon inhibition to block out competing stimuli and it requires effort, consequently it is susceptible to fatigue. In contrast, involuntary attention is, as the name implies, involuntary, it requires no effort and so it is resistant to fatigue. ART argues that our everyday lives draw heavily on the first attentional mechanism. Heavy use of this mechanism can leave it fatigued which can result in impaired decision-making, more mistakes, difficulties in processing information and maintaining attention on a task. All outcomes that can impede learning. To facilitate recovery from 'Directed Attention Fatigue' (DAF), the directed attention mechanism needs to rest. This can be achieved through sleep, which is not always a practical option, or through engagement of the second attentional mechanism, involuntary attention. Environments or experiences that capture attention effortlessly in an undramatic fashion are considered best able to engage this mechanism. ART argues that natural environments are rich in 'soft fascination', in components that effortlessly capture attention, and do so in an undramatic fashion: ripples on a pond, for example, or clouds moving through the sky. Consequently, ART argues that recovery from DAF can be more rapid and more complete in natural environments relative to built environments. In regards to learning, the tenets of ART would suggest that educational settings that provide some access to nature, be it a green view or pot plants, might enable individuals experiencing DAF to recover more quickly and more completely, and so re-engage 'cognitively refreshed' (Felsten, 2009) in a learning activity more rapidly, than might be the case in an educational setting that provided no access to nature.

The Pyschoevolutionary Theory, or Stress Reduction Theory (SRT), offers an alternative explanation for how nature might support learning. This theory argues that over millions of years of evolution humans have developed an adaptive, psycho-physiological response to natural environments (Hodson & Sander, 2017). The type of response triggered depends on the perceived characteristics of the natural setting – whether it is perceived as being 'threatening' or 'non-threatening' – and an individual's affective, cognitive and physiological state (R.S. Ulrich et al., 1991, p. 208). Contact with non-threatening nature is seen to trigger a 'restorative response' consisting of reduced levels of physiological arousal and negatively toned emotions, a move towards more positively toned emotions and approach behaviours (e.g., exploring, spending time within). Conversely, contact with threatening nature is seen to trigger a' stress response' consisting of elevated levels of physiological arousal and negatively toned emotions, such as fear, which quickly prompts avoidance behaviours. The theory posits that these adaptive responses supported our survival. They enabled humans to act very quickly, with

minimal cognitive effort, to external stimuli, such as sources of threat or risk, and to recover from stress rapidly allowing energy to be directed at tasks that support survival, such as accessing food resources in an environment (R.S. Ulrich et al., 1991, p. 208). Often discussed in tandem, ART and SRT suggest that, by reducing stress and supporting recovery from mental fatigue, nature could support students in focusing on and completing learning activities (Hodson & Sander, 2017).

Various studies have examined, and some have found evidence of, the potential for nature to support recovery from stress and mental fatigue. Research has, for instance, found that natural environments are associated with lower levels of perceived stress (Hodson & Sander, 2017). Moreover, studies that measure physiological markers of stress, such as cortisol concentrations (cortisol being the 'stress hormone'), heart rate and skin conductance (an indicator of activity in the sweat glands), indicate that recovery from stress is faster and more complete in natural settings compared to built environments (R.S. Ulrich et al., 1991; Tyrväinen et al., 2014). However, not all studies find these relationships (Tyrväinen et al., 2014). In regards to recovery from mental fatigue, Ohly et al. (2016) completed a recent systematic review of pertinent studies and, of the 31 investigations analysed, found some evidence to support claims that exposure to nature can be beneficial. However, not all investigations presented supporting evidence. It appeared that how each study measured recovery from mental fatigue, in terms of the cognitive tests used, was critical. Studies that used the forward or backward digit span test, where individuals repeat a sequence of numbers either exactly as presented by a researcher or in reverse order, or that employed the Trail Making Test B, which requires individuals to make a trail connecting randomly arranged circled numbers and letters in alternating and ascending order (1, A, 2, B, 3, C and so forth), were the only ones to identify a positive relationship between exposure to nature and recovery from mental fatigue. As different cognitive tests draw upon different cognitive processes – alerting, orientating, executive processes such as working memory and so on – and as an effect was only identified when certain cognitive tests were employed, it might be that nature has selective effects, impacting some, rather than all, cognitive functions (Ohly et al., 2016).

Nature-learning relations at educational institutions

Few studies have explicitly sought to understand the relationship between nature and learning, or learning in natural outdoor environments, in higher education settings, while no studies appear to have investigated the effects of interactions with nature on geographical higher education. However, as noted, studies have commented on the beneficial effects of undergraduate geography fieldwork conducted in natural settings (see Boyle et al., 2007; Houser et al., 2011; Leydon & Turner, 2013) and a handful of studies have explored links between pre-college interactions with nature and performance in college-level courses aligned with geography (see Greene & Byler, 2004; Mousel et al., 2006; Spero et al., 2019). Rather than universities and university students, the majority of studies on nature-learning relations have focused on schools and school-aged children (Lovell, 2016). These studies have considered various forms of exposure to nature in outdoor and indoor settings and have measured a variety of outcomes.

School based studies have looked at the possible effects of 'green views' on learning. For example, Li and Sullivan (2016) explored the effect of classroom views on attention and stress reduction at five public high schools in Illinois, USA. In this study, students were randomly assigned to classrooms with green views and to classrooms with no natural view. Those with a natural view had better attention, and lower stress, after completing a series of stressful tasks than did those without a natural view. Matsuoka (2010) examined the effects of green views on academic performance and several other outcomes across 101 public schools in Michigan, USA. After controlling for several variables commonly related to student performance, such as school socio-economic status, he found that schools with more natural views had higher aggregate test scores, higher graduation rates and rates of planned college attendance, and lower rates of criminal behaviour. The 'content' of these green views mattered. Views featuring trees and shrubs were positively related to standardized test scores, four-year college plans, and criminal behaviour, but views comprised largely of lawn areas were negatively associated with these items. Studies have investigated the effects of 'greener' school environments on learning. Wu et al. (2014) explored the relationship between the greenness of the environment around a school and academic performance using aggregate school-level test scores in maths and English for 905 public schools in Massachusetts, USA. After adjusting for various sociodemographic factors, including gender, income levels and levels of urbanization, they found that 'greener' schools had higher test scores. They also stratified their dataset using the variables of family income and gender and found that 'surrounding greenness' has generally equal effects on pupils' academic performance irrespective of gender or financial status (Wu et al., 2014, p. 7). Hodson and Sander (2017) looked at the relationship between the relative greenness of the wider environment within which a school was located and school-level performance in standardized maths and English tests. They found a significant, positive relationship between tree cover and reading performance after controlling for school-level socioeconomic and demographic factors often related to academic performance, such as the percentage of the student body eligible for free or reduced-price school lunches. As a last example, studies have looked at the impact of nature-based activities on learning. Ernst and Stanek (2006) explored the impacts of participation in a one year out-of-school learning programme that used a local prairie wetlands ecosystem as a setting within which to engage school children from a middle school in Minnesota, USA, in science, maths, and writing. Students spent two hours each day engaged in the programme over the course of a year. They found that students who participated in the programme outperformed their non-participating peers on standardized tests of reading and writing, and they performed above the Minnesota state-wide average in reading and maths.

The number of studies examining nature-learning relations in schools, and amongst school children, continues to grow, but extrapolating from these studies to higher education settings and university students, like undergraduate geography students, is problematic given the differences that exist between these age groups and learning environments. For example, it is argued that the characteristics of adult and child learners differ. Unlike child learners, adult learners are said to be self-directed and intrinsically motivated, and are able to employ their previous experiences as a rich learning resource (Knowles et al., 2020). Contributing a potentially more relevant body of evidence than school based studies are the raft of environmental psychology experiments that have used

university students as subjects when studying the effects of nature on cognitive function. These studies have explored the effects of various kinds of exposure to nature on different outcomes. Tennessen and Cimprich (1995), for example, investigated the effects of having a green view from a college dormitory window. They found that students with more natural views performed better on attention-demanding tests. Benfield et al. (2015) investigated the impact of having a green view from a classroom window. College students in an introductory reading class were either taught in a classroom with a view of a natural scene or in a classroom with a view of a concrete retaining wall. The students taught in the classroom with a natural view had higher final grades and rated the class more highly. Lee et al. (2015) examined the effects on university students of looking at simulated images of nature on a computer screen for 40-second periods. They found that those who had experienced this 'micro' exposure to nature performed significantly better on attention-demanding tests than did those who had not. Berman et al. (2008) explored the effects on university students of viewing images of nature and of taking a walk in a park. In both cases they found that performance on attention-demanding tests was improved following exposure to nature.

Nature-learning relations: the grass might not always be greener

While there is a growing body of evidence that points to the potential for nature to aid learning and associated matters, such as academic performance, not all studies find this relationship, or only find a relationship to performance in certain subjects or on certain tasks. For example, Han (2009) found no relationship between the presence of plants in a classroom and academic performance at a junior high school in Taiwan. Lethbridge et al. (2005) found no effect on the attentional capabilities of university-level nursing students following a one-hour walk in natural surroundings. Hodson and Sander (2017) found non-significant relationships between the extent of grass, shrubs and water bodies near a school and performance in maths and reading. Interestingly, they also found a *positive* relationship between the extent of *non-natural* surfaces and reading performance. Donovan et al. (2018) found a positive correlation between tree canopy cover around a child's school and their performance on reading tests, but no relationship between this and their performance on maths tests. As discussed previously, Ohly et al. (2016) found that it was only when three types of cognitive test were employed that a positive relationship was identified between exposure to nature and recovery from mental fatigue. As noted, it has been suggested that this might be because nature may only affect certain cognitive processes. Some have suggested that processes associated with "creativity" might be most affected (Barrett et al., 2017). Several studies have investigated links between nature and creativity (see Atchley, Strayer and Atchley, 2012; Studente et al., 2016; Van Rompay & Jol, 2016; Williams et al., 2018). One well known study, by Atchley, Strayer and Atchley (2012), examined the effects of a wilderness trek on creative problem solving. The researchers employed the widely used Remote Associates Test (RAT) (Mednick, 1968) to measure creative problem solving. This test asks participants to identify the connecting word through which three separate words are associated. For example, the word "cheese" connects together "cottage", "Swiss" and "cake". Within their study, one group of participants completed the test on the morning of the first day of a multi-day wilderness trek, before they set off. The second group

completed the test on the morning of the fourth day of their trek. They found that the group who completed the test on the fourth day performed better. However, Atchley et al. (2012) noted that it was not possible to determine if the second group's better performance was due to increased exposure to nature, decreased exposure to technology and the demands of everyday life, or to other factors associated with spending several days immersed in nature with a group of fellow hikers.

Factors relating to study design and execution place limits on the reliability and generalizability of some of the evidence for nature-learning relations. For example, in their systematic review of studies on the effects of regular, compulsory school- and curriculum-based outdoor education programmes, Becker et al. (2017) concluded that most of the 13 analysed studies were of only low or moderate methodological quality. Quantitative studies featured poor descriptions of the population of interest, non-random samples, inappropriate statistical techniques, and insufficient presentation of means and standard variations/standard errors for both numeric variables and main effect variables. Qualitative studies provided limited information about the influence of the researcher on the observed or interviewed participants, and vice-versa, and made inappropriate connections between the conclusions and the analyses. Lovell's (2016) review of the evidence on nature-learning relations also identified methodological weaknesses in the studies considered. She noted that many studies employed short follow-up periods and so were unable to comment on the longer term effects of exposure to nature. Many studies were relatively small scale, creating issues around the generalizability of their findings. There was often a lack of adjustment for confounders, such as socio-economic status, and for sources of bias and, for quantitative studies, control groups were rarely used. Looking across pertinent studies, other limitations can be identified. For example, studies of complex interventions that involve the manipulation of several factors are often unable to isolate the influence of "nature" relative to that of the other manipulated factors. Bälter et al. (2018), for example, investigated the impact on seminar quality, seminar discussions, and students' sense of wellbeing of conducting university seminars outside in a park "on the move", i.e. whilst walking. Although positive effects were recorded, it is unclear if this was due to being outdoors, the physical activity involved, the novelty of the situation, or a combination of these factors. Studies examining the relationship between nature and academic performance have usually focused on aggregate data (Donovan et al., 2018), which can mask differences between individuals. This is a potentially important matter given that evidence suggests there might be differences between populations in terms of the benefits accrued from contact with nature (Mitchell & Popham, 2008). For example, Overholt and Ewert (2015) explored the potential for participation in a semester-long adventure education programme to develop resilience in university students and found differences between male and female students in outcomes: while self-reported levels of resilience increased in female students, levels decreased in male students.

The potential for contact with nature to produce uneven benefits suggests that while some geography students might be supported others might be disadvantaged by measures that increase individuals' exposure to nature. Several studies, for instance, suggest that outdoor settings can be a source of genuine fear and concern for some young people (see Bixler et al., 1994; Bixler & Floyd, 1997; Dillon et al., 2006; Simmons, 1994). Students can be worried about getting lost in natural environments or may be concerned about the

risks and threats they believe nature can hold (Dillon et al., 2006). Research by Boyle et al. (2007) found that a significant minority of undergraduate geography, earth sciences and environmental sciences students reported feelings of anxiety prior to taking part in fieldwork activities. Items such as conducting activities outdoors all day, and the physical challenge of those activities, contributed to this anxiety. Furthermore, and conflicting with higher education's concern for inclusion and widening participation (Osborne, 2003), some students, such as those with certain allergies or disabilities (Hall et al., 2004), and those with limited financial resources (Fuller et al., 2006; Kent et al., 1997), might be excluded from some forms of outdoor learning. There might also be differences in experience related to such items as gender (Kent et al., 1997), sexuality and cultural background (France & Haigh, 2018). Various other challenges to the delivery of outdoor learning have also been identified, including cost, concerns about young people's health and safety, worries about liability, teacher confidence and expertise, time (Dyment, 2005; France & Haigh, 2018; Rickinson et al., 2004) and the potential for some forms of outdoor learning to be insensitive to, or exploitative of, the sites visited; for example, by reducing a complex environment to a single concept or process (McMorran, 2015). Growing concerns about climate change and the protection of fragile ecosystems (Campbell et al., 1993) also pose challenges to some forms of outdoor learning such as international fieldtrips and visits to rare and/or vulnerable environments. With matters of environmental sustainability important to many students, as evidenced by organisations and initiatives like Students Organising for Sustainability UK (n.d), there may be only limited appetite for such forms of outdoor learning in the future.

Conclusions and recommendations

There is growing evidence to suggest that various benefits, from improved academic performance to enhanced interpersonal and employability skills, might arise from incorporating some contact with nature into teaching and learning activities, be that delivering these activities outdoors or introducing natural elements into classrooms and other teaching and learning spaces and activities. However, not all studies find these relationships, some suffer from methodological weaknesses and often they have attended to the effects on pupils in schools rather than students at universities. There is a need for a greater number of appropriately controlled studies that specifically evaluate the effects of nature-based interventions on learners in higher education settings.

For geographical higher education, a review of the evidence suggests that geography educators *may* wish to consider increasing students' engagement with nature as this *may* afford learners a variety of benefits. With nature-based fieldwork and fieldtrips presenting multiple challenges around cost, inclusion, risk, sustainability and so forth, and their feasibility significantly affected by the ongoing coronavirus pandemic, focusing on increasing geography students' everyday or routine encounters with nature seems the preferable option. Largely focusing on this issue, the following recommendations for geography educators in college and university settings are suggested:

1. In introductory physical and environmental geography courses, geography educators could assess, perhaps via a survey, students' prior experience of landscape features, such as river systems and valleys. Noting the potential relationship between this experience and performance in environmental education (Spero et al., 2019), the results could

support teachers in determining how material is presented, and the level at which it is pitched, in lectures, tutorials and seminars. The results could also inform decisions about the destinations of planned fieldtrips and/or fieldwork and whether additional fieldtrips and fieldwork activities should be introduced into a course.

2. Geography educators could promote the concept of "nature-enhanced learning" to students to help individuals decide where it might be most advantageous to study, learn and watch recorded lectures, the latter being particularly relevant in light of the move to blended and online learning during the pandemic. While many may appreciate, in a broad sense, the potential benefits derived from "getting out" into nature, there is perhaps less recognition of the benefits available from remote, passive and virtual encounters with nature. Such kinds of engagement have gained new importance during the pandemic when opportunities to be outside in nature have reduced as a consequence of mobility restrictions, lockdowns and the closure of some areas of public open space (see reports of the closure of parks in the UK (Brewis, 2020), Spain (BBC News, 2020) and Italy (Reuters, 2020)). The scope to access nature outside is also affected by longer-run supply-side issues. At the city level, the ongoing densification of some urban environments (Haaland & Van Den Bosch, 2015), plus, at the university level, campus development plans, can act to reduce the availability of greenspace. Against this backdrop, building understanding of the potential for positive effects to result from indoor encounters with nature should enable more members of the university community to realize the available benefits.

3. Geography educators could bring elements of nature into their teaching practice. "Green" micro-breaks could be built into physical and human geography lectures through the use of slides showing images of nature. Introduced at strategic points within the lecture, perhaps following consideration of a complicated concept, students would be asked to quietly view the image of nature for one or two minutes. Viewing simulated images of nature for 40-seconds has been shown to support recovery from mental fatigue (Lee et al., 2015). The lecture would then resume. The author has successfully introduced this intervention into their human geography lectures. In a similar vein, at the start of a session, teachers could show an image of nature or a film showing nature settings in the background as students arrive in the classroom. Research by R. Ulrich et al. (2003) found that this kind of "background" display of nature may have stress-reducing effects. Focusing on blood donors in a waiting room, Ulrich and colleagues found that physiological markers of stress were lower when television monitors in the room showed a videotape of nature settings compared to a video tape of urban environments or daytime television. Virtual learning environments typically accompany college and university geography courses and often present large amounts of sometimes detailed information. The move to blended and online learning during the pandemic has elevated the importance of these environments in teaching and learning practice. To facilitate green micro breaks in this setting, geography teachers could add images of nature and/or clips of nature films into their virtual learning environments and encourage students to break up periods of study with time spent viewing the images/clips.

4. At a programme and/or department level, geography educators could explore opportunities to conduct some classes in natural outdoor environments, either utilizing appropriate areas of the university campus, or accessible areas of nearby nature, such as a local park. Opportunities to use on-campus outdoor areas in new ways and/or for

new learning purposes could be explored. For example, at the author's institution, an outdoor research space resembling a prehistoric campsite has been created to enable archaeology students and researchers to investigate techniques and cultural practices of the ancient past. Opportunities to use this space for outdoor seminars, tutorials or lectures in physical and human geography courses could be explored. Across the wider university campus, a network of paved paths runs through areas of green space and around a lake while a bookable 1-km cycle circuit passes through areas of open space. Opportunities to use these facilities for walking seminars (Bälter et al., 2018), tutorials or dissertation meetings could be explored. The focus on moving interactions outdoors during the coronavirus pandemic may make novel, outdoor teaching and learning activities especially appealing to students, teachers and university and college managers in the coming months, and perhaps longer term. The possible risks and scope for exclusion associated with moving learning outdoors would, of course, need to be assessed and, as appropriate, teachers would need to be provided with relevant training and support.

5. Geography educators could aim to "nurture nature" when designing curricula, teaching sessions and field trips with the goal of growing students' interactions with nature. The teaching settings, the case studies used as examples, and the subject matter covered could, where possible and appropriate, provide connections with nature. For example, an introductory human geography course could introduce students to key concepts in the discipline through activities completed in natural environments. Students could, for instance, be asked to explore a local park and take photographs of elements that appear to be "in place" and "out of place" (Cresswell, 1996). A course on research methods could provide opportunities for students to gain practical experience of different methods through "workshops" completed in natural settings. Students could, for instance, conduct walking interviews (Evans & Jones, 2011) or practice the technique of photovoice (Wang and Burris, 1997) in on-campus, or nearby, natural environments. A course on economic geography could explore core economic principles and practices through a focus on agribusinesses incorporating a field trip to a farm, managed forest or aquaculture site. As a final example, a course on historical geography could, amongst other matters, look at the evolving geographies of rural landscapes or trends in gardens and gardening. Teaching and learning materials could be populated with images of nature while fieldwork could be completed in an appropriate natural setting.

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